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ELECTRON CAPTURE HALF-LIFE OF Cm243

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### Authors

Choppin, G.R.  
Thompson, S.G.

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ELECTRON CAPTURE HALF-LIFE OF  $\text{Cm}^{243}$

G. R. Choppin and S. G. Thompson

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ELECTRON CAPTURE HALF LIFE OF  $\text{Cm}^{243}$ 

G. R. Choppin and S. G. Thompson

Radiation Laboratory and Department of Chemistry  
University of California, Berkeley, California

Calculations of closed decay-energy cycles<sup>1</sup> predict equal masses for  $\text{Am}^{243}$  and  $\text{Cm}^{243}$ , leaving unresolved the direction of beta-decay emission between these neighboring isobars. A previous attempt to milk  $\text{Am}^{243}$  from a sample of  $\text{Cm}^{243}$  produced negative results and a lower limit of 50,000 years was set for the electron-capture half-life of  $\text{Cm}^{243}$ .<sup>2</sup> However, that experiment was performed in the presence of relatively large amounts of  $\text{Am}^{241}$  and with cruder chemical separation techniques than are presently available. For the present investigation, a sample of curium was used that had been prepared by successive neutron capture in  $\text{Am}^{241}$  using the NRX reactor. The curium was purified initially in March 1951, and this plus later purifications ensured complete removal of all americium isotopes from the curium.

Following a growth period of almost ten months after the last purification, the curium was milked for  $\text{Am}^{243}$ . Isotopically pure  $\text{Am}^{241}$  was added as a chemical-yield tracer prior to the separations. Three successive elutions from Dowex-50 cation resin using ammonium alpha-hydroxyisobutyrate as eluant<sup>3</sup> were necessary for removal of all the parent curium. The americium fraction was then electroplated by a previously described method<sup>4</sup> to obtain a thin sample for pulse-height analysis. The ratio of  $\text{Am}^{243}$  to  $\text{Am}^{241}$  was determined in a 50-channel differential pulse-height analyzer and the total amount of  $\text{Am}^{243}$  calculated from the initial amount of  $\text{Am}^{241}$  activity added.

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\* Present address: Florida State University, Tallahassee, Florida.

Table I gives the relative activity intensities of the curium isotopes obtained from an alpha-particle spectrograph<sup>5</sup> and the relative weights obtained from a mass spectrometer.<sup>6</sup>

Table I

Isotope	Relative activity	Relative weights
Cm <sup>242</sup>	1.00	----
Cm <sup>243</sup>	3.01	2.43
Cm <sup>244</sup>	1.95	1.00

These data can be used with the best value for the half-life of Cm<sup>244</sup> (18.4 ± .5 years<sup>7</sup>) to obtain an alpha half-life for Cm<sup>243</sup> of 29.0 ± 0.8 years.

In a similar manner the electron-capture half-life of Cm<sup>243</sup> can be calculated from the expression

$$t_{1/2}^{63} = 0.693 \Delta t \frac{N_{63}}{N_{53}},$$

where  $\Delta t$  represents the time of Am<sup>243</sup> growth (0.821 years), 63 refers to Cm<sup>243</sup> and 53 refers to Am<sup>243</sup>.  $N_{63}$  was obtained by use of the 29.0-year value given above and  $N_{53}$  by use of a value of 7951 ± 48 years<sup>8</sup> for the Am<sup>243</sup> half-life. From 2.2 × 10<sup>7</sup> d/m of Cm<sup>243m</sup>, 4.10 d/m of Am<sup>243</sup> was milked. The half-life calculated for electron capture in Cm<sup>243</sup> was 1.1 ± 0.1 × 10<sup>4</sup> years. The errors reported are based upon the estimated half-life errors in Cm<sup>244</sup> and Am<sup>243</sup> and the errors in counting and assaying.

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